

**CPC****COOPERATIVE PATENT CLASSIFICATION****C01F**

**COMPOUNDS OF THE METALS BERYLLIUM, MAGNESIUM, ALUMINIUM, CALCIUM, STRONTIUM, BARIUM, RADIUM, THORIUM, OR OF THE RARE-EARTH METALS** (metal hydrides { monoborane, diborane or addition complexes thereof} [C01B 6/00](#); salts of oxyacids of halogens [C01B 11/00](#); peroxides, salts of peroxyacids [C01B 15/00](#); sulfides or polysulfides of magnesium, calcium, strontium, or barium [C01B 17/42](#); thiosulfates, dithionites, polythionates [C01B 17/64](#); compounds containing selenium or tellurium [C01B 19/00](#); binary compounds of nitrogen with metals [C01B 21/06](#); azides [C01B 21/08](#); { compounds other than ammonia or cyanogen containing nitrogen and non-metals and optionally metals [C01B 21/082](#); amides or imides of silicon [C01B 21/087](#)}; metal { imides or} amides [C01B 21/092](#), {[C01B 21/0923](#)}; nitrites [C01B 21/50](#); { compounds of noble gases [C01B 23/0005](#)}; phosphides [C01B 25/08](#); salts of oxyacids of phosphorus [C01B 25/16](#); carbides [C01B 31/30](#); compounds containing silicon [C01B 33/00](#); compounds containing boron [C01B 35/00](#); compounds having molecular sieve properties but not having base-exchange properties [C01B 37/00](#); compounds having molecular sieve and base-exchange properties, e.g. crystalline zeolites, [C01B 39/00](#); cyanides [C01C 3/08](#); salts of cyanic acid [C01C 3/14](#); salts of cyanamide [C01C 3/16](#); thiocyanates [C01C 3/20](#); { double sulfates of magnesium with sodium or potassium [C01D 5/12](#); with other alkali metals [C01D 15/00](#), [C01D 17/00](#)})

**C01F 1/00**                    **Methods of preparing compounds of the metals beryllium, magnesium, aluminium, calcium, strontium, barium, radium, thorium, or the rare earths, in general**

**C01F 3/00**                    **Compounds of beryllium**

C01F 3/005                . {Fluorides or double fluorides of beryllium with alkali metals or ammonium; Preparation of beryllium compounds therefrom}

C01F 3/02                 . Oxides; Hydroxides

**C01F 5/00**                    **Compounds of magnesium**

C01F 5/02                 . Magnesia

C01F 5/04                 .. by oxidation of metallic magnesium

C01F 5/06                 .. by thermal decomposition of magnesium compounds (calcining magnesite or dolomite [C04B 2/10](#))

C01F 5/08                 ... by calcining magnesium hydroxide

C01F 5/10                 ... by thermal decomposition of magnesium chloride with water vapour

C01F 5/12                 ... by thermal decomposition of magnesium sulfate, with or without reduction

C01F 5/14                 . Magnesium hydroxide

C01F 5/145                .. {Purification}

- C01F 5/16 .. by treating magnesia, e.g. calcined dolomite, with water or solutions of salts not containing magnesium
- C01F 5/20 .. by precipitation from solutions of magnesium salts with ammonia
- C01F 5/22 .. from magnesium compounds with alkali hydroxides or alkaline- earth oxides or hydroxides
  
- C01F 5/24 . Magnesium carbonates
  
- C01F 5/26 . Magnesium halides
  - C01F 5/28 .. Fluorides
  - C01F 5/30 .. Chlorides
  - C01F 5/305 ... {Dehydrating ammonium or alkali magnesium chlorides, e.g. carnalite}
  - C01F 5/32 ... Preparation of anhydrous magnesium chloride by chlorinating magnesium compounds
  - C01F 5/34 ... Dehydrating magnesium chloride containing water of crystallisation
  - C01F 5/36 .. Bromides
  
- C01F 5/38 . Magnesium nitrates
  
- C01F 5/40 . Magnesium sulfates (double sulfates of magnesium with sodium or potassium [C01D 5/12](#), with other alkali metals {[C01D 15/00](#)}, [C01D 17/00](#))
  
- C01F 5/42 . Magnesium sulfites
  
- C01F 7/00                    Compounds of aluminium**
  
- C01F 7/001 . {Aluminium carbonate}
  
- C01F 7/002 . {Compounds containing, besides aluminium, two or more other elements, with the exception of oxygen and hydrogen (compounds containing aluminium, fluorine and alkali or alkaline earth metals [C01F 7/54](#); compounds containing sulfur and other cations besides aluminium [C01F 7/68](#))}
  
- C01F 7/004 .. {containing carbonate ions, e.g. dawsonite}
- C01F 7/005 ... {Hydrotalcite}
- C01F 7/007 .. {containing, besides aluminium, only anions, e.g. Al(OH)<sub>x</sub>CL<sub>y</sub>(SO<sub>4</sub>)<sub>z</sub> (mixed halides [C01F 7/48](#))}
- C01F 7/008 .. {Ammonium aluminium fluorides}
  
- C01F 7/02 . Aluminium oxide; Aluminium hydroxide; Aluminates
  - C01F 7/021 .. {After-treatment of oxides or hydroxides}
  - C01F 7/022 ... {Classification}
  - C01F 7/023 ... {Grinding, deagglomeration, disintegration}
  - C01F 7/025 ... {Granulation, agglomeration}
  - C01F 7/026 ... {Making or stabilising dispersions}
  - C01F 7/027 ... {Treatment involving fusion or vaporisation}
  - C01F 7/028 .. {Beta-aluminas}
  - C01F 7/04 .. Preparation of alkali metal aluminates; Aluminium oxide or hydroxide therefrom

- [C01F 7/028](#) takes precedence)}
- C01F 7/043 ... {Lithium aluminate}
- C01F 7/046 ... {Stabilisation of aluminates}
- C01F 7/06 ... by treating aluminous minerals {or waste-like raw materials} with alkali hydroxide, {e.g. leaching of bauxite according to the Bayer process (obtaining aluminium oxide or hydroxide from the resulting aluminate solution [C01F 7/14](#))}
- C01F 7/0606 ..... {Make-up of the alkali hydroxide solution from recycled spent liquor}
- C01F 7/0613 ..... {Pretreatment of the minerals, e.g. grinding}
- C01F 7/062 ..... {Digestion}
- C01F 7/0626 ..... {Processes making use of tube digestion only}
- C01F 7/0633 ..... {characterised by the use of additives}
- C01F 7/064 ..... {Apparatus for digestion, e.g. digester vessels, heat exchangers}
- C01F 7/0646 ..... {Separation of the insoluble residue, e.g. red mud}
- C01F 7/0653 ..... {characterised by the flocculant added to the slurry (final clarification of the aluminate solution [C01F 7/47](#))}
- C01F 7/066 ..... {Treatment of the separated residue}
- C01F 7/0666 ..... {Process control or regulation (control *per se* [G05](#))}
- C01F 7/0673 ..... {from phosphate-containing minerals}
- C01F 7/068 ..... {from carbonate-containing minerals, e.g. dawsonite}
- C01F 7/0686 ..... {from sulfate-containing minerals, e.g. alunite}
- C01F 7/0693 ..... {from waste-like raw materials, e.g. fly ash, Bayer calcination dust}
- C01F 7/08 ... by treating aluminous minerals with sodium carbonate, {e.g. sinter processes ([C01F 7/0613](#) and [C01F 7/066](#) take precedence)}
- C01F 7/085 ..... {according to the lime-sinter process}
- C01F 7/10 ... by treating aluminous minerals with alkali sulfates and reducing agents
- C01F 7/12 ... Alkali metal aluminates from alkaline-earth metal aluminates
- C01F 7/14 ... Aluminium oxide or hydroxide from alkali metal aluminates
- C01F 7/141 ..... {from aqueous aluminate solutions by neutralisation with an acidic agent}
- C01F 7/142 ..... {with carbon dioxide}
- C01F 7/144 ..... {from aqueous aluminate solutions by precipitation due to cooling, e.g. as part of the Bayer process}
- C01F 7/145 ..... {characterised by a crystal growth modifying agent other than aluminium hydroxide seed}
- C01F 7/147 ..... {Apparatus for precipitation}
- C01F 7/148 ..... {Separation of the obtained hydroxide, e.g. filtration, dewatering}
- C01F 7/16 .. Preparation of alkaline-earth metal aluminates {or magnesium aluminate}; Aluminium oxide or hydroxide therefrom {([C01F 7/028](#) takes precedence)}
- C01F 7/162 ... {Magnesium aluminates}
- C01F 7/164 ... {Calcium aluminates}
- C01F 7/166 ... {Strontium aluminates}
- C01F 7/168 ... {Barium aluminates}
- C01F 7/18 ... Aluminium oxide or hydroxide from alkaline-earth metal aluminates
- C01F 7/20 .. Preparation of aluminium oxide or hydroxide from aluminous ores with acids or salts

- C01F 7/22           ...     with halides { or halogen acids}
- C01F 7/24           ...     with nitric acid or nitrogen oxides
- C01F 7/26           ...     with sulfuric acids or sulfates
- C01F 7/28           ...     with sulfurous acid
- C01F 7/30           ..     Preparation of aluminium oxide or hydroxide by thermal decomposition {or by hydrolysis or oxidation} of aluminium compounds
- C01F 7/302          ...     {Hydrolysis or oxidation of gaseous aluminium compounds in the gas phase}
- C01F 7/304          ....     {of organic aluminium compounds}
- C01F 7/306          ...     {Thermal decomposition of hydrated chlorides, e.g. aluminium trichloride hexahydrate}
- C01F 7/308          ...     {Thermal decomposition of nitrates}
- C01F 7/32           ...     {Thermal decomposition} of sulfates {including complex sulfates, e.g. alums}
- C01F 7/34           ..     Preparation of aluminium hydroxide by precipitation from solutions containing aluminium salts
- C01F 7/36           ...     from organic aluminium salts
- C01F 7/38           ..     Preparation of aluminium oxide by thermal reduction of aluminous minerals
- C01F 7/40           ...     in the presence of aluminium sulfide
- C01F 7/42           ..     Preparation of aluminium oxide or hydroxide from metallic aluminium, e.g. by oxidation
- C01F 7/422          ...     {by oxidation with a gaseous oxidator at a high temperature}
- C01F 7/424          ....     {using a plasma}
- C01F 7/426          ...     {by applying mechanical energy to solid aluminium at a low temperature}
- C01F 7/428          ...     {by oxidation in an aqueous solution}
- C01F 7/44           ..     Dehydration of aluminium {oxide or} hydroxide, {i.e. all conversions of one form into another involving a loss of water}
- C01F 7/441          ...     {by calcination}
- C01F 7/442          ....     {in presence of a calcination additive}
- C01F 7/444          ....     {Apparatus therefor}
- C01F 7/445          ....     {making use of a fluidised bed}
- C01F 7/447          ...     {by wet processes}
- C01F 7/448          ....     {using superatmospheric pressure, e.g. hydrothermal conversion of gibbsite into boehmite}
- C01F 7/46           ..     Purification of aluminium oxide, aluminium hydroxide or aluminates {(7/02H takes precedence)}
- C01F 7/47           ...     of aluminates, {e.g. removal of compounds of Si, Fe, Ga or of organic compounds from Bayer process liquors}
- C01F 7/473          ....     {Removal of organic compounds, e.g. sodium oxalate}
- C01F 7/476          .....     {by oxidation}
- C01F 7/48           .     Aluminium halides
- C01F 7/50           ..     Fluorides
- C01F 7/52           ...     Double compounds containing both fluorine and other acid { halide} groups
- C01F 7/54           ...     Double compounds containing both aluminium and alkali metals or alkaline-earth metals
- C01F 7/56           ..     Chlorides (containing fluorine [C01F 7/52](#))

- C01F 7/58 . . . Preparation of anhydrous aluminium chloride
- C01F 7/60 . . . . from oxygen-containing aluminium compounds
- C01F 7/62 . . . Purification
- C01F 7/64 . . Bromides ([containing fluorine C01F 7/52](#))
  
- C01F 7/66 . Aluminium nitrates ([containing fluorine {C01F 7/002}](#))
  
- C01F 7/68 . Aluminium compounds containing sulfur ([containing fluorine {C01F 7/002}](#))
- C01F 7/70 . . Sulfides
- C01F 7/72 . . Sulfites
- C01F 7/74 . . Sulfates
- C01F 7/741 . . . {Preparation from elemental aluminium or elemental aluminium containing materials, e.g. foil, dross}
- C01F 7/743 . . . {Preparation from silicoaluminous materials, e.g. clays, bauxite}
- C01F 7/745 . . . {Preparation from alums, e.g. alunite}
- C01F 7/746 . . . {After-treatment, e.g. dehydration, stabilisation}
- C01F 7/748 . . . . {Purification}
- C01F 7/76 . . . Double salts, {i.e. compounds containing, besides aluminium and sulfate ions, only other cations}, e.g. alums
- C01F 7/762 . . . . {Ammonium or alkali metal aluminium sulfates}
- C01F 7/765 . . . . . {Ammonium aluminium sulfates}
- C01F 7/767 . . . . {Alkaline earth metal aluminium sulfates}
  
- C01F 11/00** **Compounds of calcium, strontium, or barium ([C01F 7/00](#) takes precedence)**
  
- C01F 11/005 . {Preparation involving liquid-liquid extraction, absorption or ion-exchange}
  
- C01F 11/02 . Oxides or hydroxides ([production of lime C04B 2/00](#))
- C01F 11/04 . . by thermal decomposition
- C01F 11/06 . . . of carbonates
- C01F 11/08 . . by reduction of sulfates
- C01F 11/10 . . from sulfides
- C01F 11/12 . . from silicates
- C01F 11/16 . . Purification
  
- C01F 11/18 . Carbonates
- C01F 11/181 . . {Preparation of calcium carbonate by carbonation of aqueous solutions and characterised by control of the carbonation conditions}
- C01F 11/182 . . {Preparation of calcium carbonate by carbonation of aqueous solutions and characterised by an additive other than CaCO<sub>3</sub>-seeds}
- C01F 11/183 . . . {the additive being an organic compound}
- C01F 11/184 . . {Preparation of calcium carbonate by carbonation of solutions based on non-aqueous solvents}
- C01F 11/185 . . {After-treatment, e.g. grinding, purification, conversion of crystal morphology}
- C01F 11/186 . . {Strontium or barium carbonate}

- C01F 11/187 ... {Strontium carbonate}
- C01F 11/188 ... {Barium carbonate}
- C01F 11/20 . Halides
- C01F 11/22 .. Fluorides
- C01F 11/24 .. Chlorides
- C01F 11/26 ... from sulfides
- C01F 11/28 ... by chlorination of alkaline-earth metal compounds
- C01F 11/30 ... Concentrating; Dehydrating; Preventing the adsorption of moisture or caking
- C01F 11/32 ... Purification
- C01F 11/34 .. Bromides
- C01F 11/36 . Nitrates
- C01F 11/38 .. Preparation with nitric acid or nitrogen oxides
- C01F 11/40 .. Preparation by double decomposition with nitrates
- C01F 11/42 .. Double salts (with magnesium [C01F 5/38](#))
- C01F 11/44 .. Concentrating; Crystallising; Dehydrating; Preventing the absorption of moisture or caking
- C01F 11/46 . Sulfates (dehydration of gypsum {for the production of calcium sulfate cements}[C04B 11/02](#))
- C01F 11/462 .. {Sulfates of Sr or Ba}
- C01F 11/464 .. {Sulfates of Ca from gases containing sulfur oxides}
- C01F 11/466 .. {Conversion of one form of calcium sulfate to another}
- C01F 11/468 .. {Purification of calcium sulfates}
- C01F 11/48 . Sulfites
- C01F 13/00           Compounds of radium**
- C01F 15/00           Compounds of thorium**
- C01F 17/00           Compounds of the rare earth metals, i.e. scandium, yttrium, lanthanum, or the group of the lanthanides**
- NOTE**
- In this group "rare earth metals" means one single element or a combination of elements taken from the group as specified above
- C01F 17/0006 . {Preparation involving a liquid-liquid extraction, an adsorption or an ion exchange}
- C01F 17/0012 . {Compounds containing besides rare earth metals two or more other element with the exception of oxygen or hydrogen, e.g. La<sub>4</sub>S<sub>3</sub>Br<sub>6</sub> or ternary oxides or hydroxides, e.g. NaCeO<sub>2</sub>}
- C01F 17/0018 .. {Oxygen being the only anion}

- C01F 17/0025 . . . {Aluminates}
- C01F 17/0031 . . {Halogen being the only anion (compounds containing besides rare earth metals only different halogens, e.g. Sc [C01F 17/0056](#))}
- C01F 17/0037 . . {Sulfur being the only anion}
- C01F 17/0043 . {Oxides or hydroxides (ternary oxides or hydroxides, e.g. NaCeO<sub>2</sub> [C01F 17/0018](#))}
- C01F 17/005 . {Carbonates}
- C01F 17/0056 . {Halides}
- C01F 17/0062 . . {Fluorides}
- C01F 17/0068 . . {Chlorides}
- C01F 17/0075 . {Nitrates}
- C01F 17/0081 . {Sulfates}
- C01F 17/0087 . {Sulfides}
- C01F 17/0093 . . {Oxysulfides}